

BIG LOST RIVER WATERSHED SUBBASIN ASSESSMENT AND TMDL



Final



Department of Environmental Quality

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GIS Coverages:

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Glossary

305(b)	Refers to section 305 subsection “b” of the Clean Water Act. 305(b) generally describes a report of each state’s water quality, and is the principle means by which the U.S. Environmental Protection Agency, Congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
§303(d)	Refers to section 303 subsection “d” of the Clean Water Act. 303(d) requires states to develop a list of waterbodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-Foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Assessment Database (ADB)	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of waterbodies, and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.
Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.
Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.

Alevin	A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a waterbody, living off stored yolk.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anoxia	The condition of oxygen absence or deficiency.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given waterbody; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assimilative Capacity	The ability to process or dissipate pollutants without ill effect to beneficial uses.
Autotrophic	An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.

Batholith	A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.
Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of waterbodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers
Benthic	Pertaining to or living on or in the bottom sediments of a waterbody
Benthic Organic Matter.	The organic matter on the bottom of a waterbody.
Benthos	Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.
Best Professional Judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biological Integrity	1) The condition of an aquatic community inhabiting unimpaired waterbodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic life (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).
Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.

Clean Water Act (CWA)	The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Measured in Colony Forming Units (CFU), Colonies per 100 ml of sample. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (μ) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.
Cubic Feet per Second	A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.
Cultural Eutrophication	The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).
Culturally Induced Erosion	Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).
Debris Torrent	The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.

Decomposition	The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.
Depth Fines	Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).
Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
<i>E. coli</i>	Short for <i>Escherichia Coli</i> , <i>E. coli</i> are a group of bacteria that are a subspecies of coliform bacteria. Most <i>E. coli</i> are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving waterbody.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.

Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Eocene	An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.
Eolian	Windblown, referring to the process of erosion, transport, and deposition of material by the wind.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).
Erosion	The wearing away of areas of the earth's surface by water, wind, ice, and other forces.
Eutrophic	From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.
Eutrophication	1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's <i>Water Quality Standards and Wastewater Treatment Requirements</i> (IDAPA 58.01.02).
Exotic Species	A species that is not native (indigenous) to a region.
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria).
Fecal Streptococci	A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.

Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.
Focal	Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the <i>Water Body Assessment Guidance</i> (Grafe et al. 2002).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but Threatened	An intermediate assessment category describing waterbodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a “not fully supporting” status.
Geographical Information Systems (GIS)	A georeferenced database.
Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
Gradient	The slope of the land, water, or streambed surface.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Growth Rate	A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Cycle	The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.
Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.
Hydrologic Unit Code (HUC)	The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.
Hydrology	The science dealing with the properties, distribution, and circulation of water.
Impervious	Describes a surface, such as pavement, that water cannot penetrate.
Influent	A tributary stream.
Inorganic	Materials not derived from biological sources.
Instantaneous	A condition or measurement at a moment (instant) in time.
Intergravel Dissolved Oxygen	The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.
Intermittent Stream	1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.
Interstate Waters	Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Key Watershed	A watershed that has been designated in Idaho Governor Batt's <i>State of Idaho Bull Trout Conservation Plan</i> (1996) as critical to the long-term persistence of regionally important trout populations.
Knickpoint	Any interruption or break of slope.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Limiting Factor	A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.
Limnology	The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.
Load Allocation (LA)	A portion of a waterbody's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Loading Capacity (LC)	A determination of how much pollutant a waterbody can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Loam	Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.
Loess	A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.
Lotic	An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.
Luxury Consumption	A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a waterbody, such that aquatic plants take up and store an abundance in excess of the plants' current needs.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.

Macrophytes	Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (<i>Ceratophyllum sp.</i>), are free-floating forms not rooted in sediment.
Margin of Safety (MOS)	An implicit or explicit portion of a waterbody's loading capacity set aside to allow the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Mass Wasting	A general term for the down slope movement of soil and rock material under the direct influence of gravity.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.
Median	The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.
Metric	1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.
Milligrams per liter (mg/L)	A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).
Million gallons per day (MGD)	A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.
Miocene	Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a waterbody.
Mouth	The location where flowing water enters into a larger waterbody.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.

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Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nodal	Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing waterbodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing waterbodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the <i>Water Body Assessment Guidance</i> (Grafe et al. 2002).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).
Oligotrophic	The Greek term for “poorly nourished.” This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a waterbody that consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Partitioning	The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.
Pathogens	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a waterbody or on submerged substrates, including larger plants.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
pH	The negative \log_{10} of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a waterbody. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Physiochemical	In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms “physical/chemical” and “physicochemical.”

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Plankton	Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable “point” of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Pretreatment	The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.
Primary Productivity	The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.
Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction.
Quality Assurance (QA)	A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).
Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.

Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.
Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a waterbody that is minimally impaired and is representative of reference conditions for similar waterbodies.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a waterbody.
Riparian Habitat Conservation Area (RHCA)	A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams: <ul style="list-style-type: none">- 300 feet from perennial fish-bearing streams- 150 feet from perennial non-fish-bearing streams- 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stagnation	The absence of mixing in a waterbody.
Stenothermal	Unable to tolerate a wide temperature range.
Stratification	A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.
Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4 th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6 th field hydrologic units.
Surface Fines	Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.
Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Tertiary	An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.
Thalweg	The center of a stream's current, where most of the water flows.
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Total Maximum Daily Load (TMDL)	A TMDL is a waterbody's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. $TMDL = Loading\ Capacity = Load\ Allocation + Wasteload\ Allocation + Margin\ of\ Safety$. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several waterbodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.
Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary Trophic State	A stream feeding into a larger stream or lake. The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll <i>a</i> concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.
Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.
Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary Trophic State	A stream feeding into a larger stream or lake. The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll <i>a</i> concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.
Turbidity	A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.
Vadose Zone	The unsaturated region from the soil surface to the ground water table.
Wasteload Allocation (WLA)	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a waterbody.

Waterbody	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.
Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality Limited	A label that describes waterbodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Modeling	The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.
Water Quality Standards	State-adopted and EPA-approved ambient standards for waterbodies. The standards prescribe the use of the waterbody and establish the water quality criteria that must be met to protect designated uses.
Water Table	The upper surface of ground water; below this point, the soil is saturated with water.

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Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller “subwatersheds.” 2) The whole geographic region which contributes water to a point of interest in a waterbody.
Waterbody Identification Number (WBID)	A number that uniquely identifies a waterbody in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.

Appendix A. Unit Conversion Chart

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Table B1. Metric - English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft ²) Square Miles (mi ²)	Hectares (ha) Square Meters (m ²) Square Kilometers (km ²)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft ² = 0.09 m ² 1 m ² = 10.76 ft ² 1 mi ² = 2.59 km ² 1 km ² = 0.39 mi ²	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft ² = 0.28 m ² 3 m ² = 32.29 ft ² 3 mi ² = 7.77 km ² 3 km ² = 1.16 mi ²
Volume	Gallons (g) Cubic Feet (ft ³)	Liters (L) Cubic Meters (m ³)	1 g = 3.78 l 1 l = 0.26 g 1 ft ³ = 0.03 m ³ 1 m ³ = 35.32 ft ³	3 g = 11.35 l 3 l = 0.79 g 3 ft ³ = 0.09 m ³ 3 m ³ = 105.94 ft ³
Flow Rate	Cubic Feet per Second (ft ³ /sec) ¹	Cubic Meters per Second (m ³ /sec)	1 ft ³ /sec = 0.03 m ³ /sec 1 m ³ /sec = ft ³ /sec	3 ft ³ /sec = 0.09 m ³ /sec 3 m ³ /sec = 105.94 ft ³ /sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L ²	3 ppm = 3 mg/L
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 kg
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 °C = 37.4 °F

¹ 1 ft³/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft³/sec.

²The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

Appendix B. State and Site-Specific Standards and Criteria

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003. DEFINITIONS.

For the purpose of the rules contained in IDAPA 58.01.02, "Water Quality Standards and Wastewater Treatment Requirements," the following definitions apply: (4-5-00)

01. **Acute.** Involving a stimulus severe enough to rapidly induce a response; in aquatic toxicity tests, a response measuring lethality observed in ninety-six (96) hours or less is typically considered acute. When referring to human health, an acute effect is not always measured in terms of lethality. (3-20-97)

02. **Acute Criteria.** Unless otherwise specified in these rules, the maximum instantaneous or one (1) hour average concentration of a toxic substance or effluent which ensures adequate protection of sensitive species of aquatic organisms from acute toxicity resulting from exposure to the toxic substance or effluent. Acute criteria will adequately protect the designated aquatic life use if not exceeded more than once every three (3) years. The terms "acute criteria" and "criterion maximum concentration" (CMC) are equivalent. (3-15-02)

03. **Acute Toxicity.** The existence of mortality or injury to aquatic organisms resulting from a single or short-term (i.e., ninety-six (96) hours or less) exposure to a substance. As applied to toxicity tests, acute toxicity refers to the response of aquatic test organisms to a concentration of a toxic substance or effluent which results in a LC-50. (3-20-97)

04. **Beneficial Use.** Any of the various uses which may be made of the water of Idaho, including, but not limited to, domestic water supplies, industrial water supplies, agricultural water supplies, navigation, recreation in and on the water, wildlife habitat, and aesthetics. The beneficial use is dependent upon actual use, the ability of the water to support a non-existing use either now or in the future, and its likelihood of being used in a given manner. The use of water for the purpose of wastewater dilution or as a receiving water for a waste treatment facility effluent is not a beneficial use. (8-24-94)

05. **Available.** Based on public wastewater system size, complexity, and variation in raw waste, a certified wastewater operator must be on site or able to be contacted as needed to initiate the appropriate action for

050. ADMINISTRATIVE POLICY.

01. **Apportionment Of Water.** The adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the state through any of the interstate compacts or court decrees, or to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure, or to interfere with water quality criteria established by mutual agreement of the participants in interstate water pollution control enforcement procedures. (7-1-93)

02. **Protection Of Waters Of The State.** (7-1-93)

a. Wherever attainable, surface waters of the state shall be protected for beneficial uses which for surface waters includes all recreational use in and on the water surface and the preservation and propagation of desirable species of aquatic life; (4-5-00)

b. In all cases, existing beneficial uses of the waters of the state will be protected. (7-1-93)

03. **Annual Program.** To fully achieve and maintain water quality in the state, it is the intent of the Department to develop and implement a Continuing Planning Process that describes the on-going planning requirements of the State's Water Quality Management Plan. The Department's planned programs for water pollution control comprise the State's Water Quality Management Plan. (4-5-00)

04. **Program Integration.** Whenever an activity or class of activities is subject to provisions of these rules, as well as other regulations or standards of either this Department or other Governmental agency, the Department will seek and employ those methods necessary and practicable to integrate the implementation, administration and enforcement of all applicable regulations through a single program. Integration will not, however, be affected to the extent that applicable provisions of these rules would fail to be achieved or maintained unless the Department's role in these cases is limited by state statute or federal law. (7-1-93)

05. **Revisions.** These rules are subject to amendment as technical data, surveillance programs, and technological advances require. Any revisions made to these rules shall be in accordance with Sections 39-101, et seq., and 67-5201, et seq., Idaho Code. (8-24-94)

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051. ANTIDegradation Policy.

01. **Maintenance Of Existing Uses For All Waters.** The existing in stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected. (7-1-93)

02. **High Quality Waters.** Where the quality of the waters exceeds levels necessary to support propagation of fish, shellfish and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the Department finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the Department's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the Department shall assure water quality adequate to protect existing uses fully. Further, the Department shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and cost-effective and reasonable best management practices for nonpoint source control. In providing such assurance, the Department may enter together into an agreement with other state of Idaho or federal agencies in accordance with Sections 67-2326 through 67-2333, Idaho Code. (7-1-93)

100. SURFACE WATER USE DESIGNATIONS.

Waterbodies are designated in Idaho to protect water quality for existing or designated uses. The designated use of a waterbody does not imply any rights to access or ability to conduct any activity related to the use designation, nor does it imply that an activity is safe. For example, a designation of primary or secondary contact recreation may occur in areas where it is unsafe to enter the water due to water flows, depth or other hazardous conditions. Another example is that aquatic life uses may be designated in areas that are closed to fishing or access is not allowed by property owners. Wherever attainable, the designated beneficial uses for which the surface waters of the state are to be protected include: (3-15-02)

01. Aquatic Life. (7-1-93)

a. Cold water (COLD): water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species. (4-5-00)

b. Salmonid spawning: waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes. (7-1-93)

c. Seasonal cold water (SC): water quality appropriate for the protection and maintenance of a viable aquatic life community of cool and cold water species, where cold water aquatic life may be absent during, or tolerant of, seasonally warm temperatures. (4-5-00)

d. Warm water (WARM): water quality appropriate for the protection and maintenance of a viable aquatic life community for warm water species. (4-5-00)

e. Modified (MOD): water quality appropriate for an aquatic life community that is limited due to one (1) or more conditions set forth in 40 CFR 131.10(g) which preclude attainment of reference streams or conditions. (4-5-00)

02. Recreation. (7-1-93)

a. Primary contact recreation (PCR): water quality appropriate for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, those used for swimming, water skiing, or skin diving. (4-5-00)

b. Secondary contact recreation (SCR): water quality appropriate for recreational uses on or about the water and which are not included in the primary contact category. These activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur. (4-5-00)

03. Water Supply. (7-1-93)

a. Domestic: water quality appropriate for drinking water supplies. (4-5-00)

b. Agricultural: water quality appropriate for the irrigation of crops or as drinking water for livestock. This use applies to all surface waters of the state. (4-5-00)

c. Industrial: water quality appropriate for industrial water supplies. This use applies to all surface waters of the state. (4-5-00)

04. **Wildlife Habitats.** Water quality appropriate for wildlife habitats. This use applies to all surface waters of the state. (4-5-00)

05. **Aesthetics.** This use applies to all surface waters of the state. (7-1-93)

101. NONDESIGNATED SURFACE WATERS.

01. **Undesignated Surface Waters.** Surface waters not designated in Sections 110 through 160 shall

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be designated according to Section 39-3604, Idaho Code, taking into consideration the use of the surface water and such physical, geological, chemical, and biological measures as may affect the surface water. Prior to designation, undesignated waters shall be protected for beneficial uses, which includes all recreational use in and on the water and the protection and propagation of fish, shellfish, and wildlife, wherever attainable. (3-23-98)

a. Because the Department presumes most waters in the state will support cold water aquatic life and primary or secondary contact recreation beneficial uses, the Department will apply cold water aquatic life and primary or secondary contact recreation criteria to undesignated waters unless Sections 101.01.b and 101.01.c. are followed. (4-5-00)

b. During the review of any new or existing activity on an undesignated water, the Department may examine all relevant data or may require the gathering of relevant data on beneficial uses; pending determination in Section 101.01.c. existing activities will be allowed to continue. (3-23-98)

c. If, after review and public notice of relevant data, it is determined that beneficial uses in addition to or other than cold water aquatic life and primary or secondary contact recreation are appropriate, then the Department will: (4-5-00)

i. Complete the review and compliance determination of the activity in context with the new information on beneficial uses, and (3-23-98)

ii. Initiate rulemaking necessary to designate the undesignated water, including providing all necessary data and information to support the proposed designation. (3-23-98)

02. Man-Made Waterways. Unless designated in Sections 110 through 160, man-made waterways are to be protected for the use for which they were developed. (7-1-93)

03. Private Waters. Unless designated in Sections 110 through 160, lakes, ponds, pools, streams and springs outside public lands but located wholly and entirely upon a person's land are not protected specifically or generally for any beneficial use. (7-1-93)

250. SURFACE WATER QUALITY CRITERIA FOR AQUATIC LIFE USE DESIGNATIONS.

01. General Criteria. The following criteria apply to all aquatic life use designations. Surface waters are not to vary from the following characteristics due to human activities: (3-15-02)

a. Hydrogen Ion Concentration (pH) values within the range of six point five (6.5) to nine point zero (9.0); (3-30-01)

b. The total concentration of dissolved gas not exceeding one hundred and ten percent (110%) of saturation at atmospheric pressure at the point of sample collection; (7-1-93)

02. Cold Water. Waters designated for cold water aquatic life are not to vary from the following characteristics due to human activities: (3-15-02)

a. Dissolved Oxygen Concentrations exceeding six (6) mg/l at all times. In lakes and reservoirs this standard does not apply to: (7-1-93)

i. The bottom twenty percent (20%) of water depth in natural lakes and reservoirs where depths are thirty-five (35) meters or less. (7-1-93)

ii. The bottom seven (7) meters of water depth in natural lakes and reservoirs where depths are greater than thirty-five (35) meters. (7-1-93)

iii. Those waters of the hypolimnion in stratified lakes and reservoirs. (7-1-93)

b. Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C. (8-24-94)

c. Temperature in lakes shall have no measurable change from natural background conditions. Reservoirs with mean detention times of greater than fifteen (15) days are considered lakes for this purpose. (3-15-02)

d. Ammonia. The following criteria are not to be exceeded dependant upon the temperature, T (degrees C), and pH of the water body: (3-15-02)

251. SURFACE WATER QUALITY CRITERIA FOR RECREATION USE DESIGNATIONS.

01. Primary Contact Recreation. Waters designated for primary contact recreation are not to contain E.coli bacteria significant to the public health in concentrations exceeding: (4-5-00)

a. For areas within waters designated for primary contact recreation that are additionally specified as public swimming beaches, a single sample of two hundred thirty-five (235) E. coli organisms per one hundred (100) ml. For the purpose of this subsection, "specified public swimming beaches" are considered to be indicated by features such as signs, swimming docks, diving boards, slides, or the like, boater exclusion zones, map legends, collection of a fee for beach use, or any other unambiguous invitation to public swimming. Privately owned swimming docks or the like which are not open to the general public are not included in this definition. (3-15-02)

Appendix C. Data Sources

Table C1. Data sources for Big Lost River Subbasin Assessment.

Waterbody	Data Source	Type of Data	When Collected
Big Lost River Subbasin	Bart Gamett, USDA FS Lost River Ranger District	Temperature, Fish	August 2003
East Fork, North Fork Big Lost and associated subbasins	Dan Garren, IDFG, Upper Snake Regional Office	Fish	August 2003
East Fork, Antelope Cr., Warm Springs Cr., Bear Cr.	Ron Rope, INEEL Environmental Section	Erosion Inventory, Depth Fines	October 2002
Big Lost River	Idaho State University	Nutrient, Flow, Macroinvertebrate	October 2002
Deep Creek, Sage Creek, Garden Creek, Lake Creek, Burnt Creek, Twin Bridges Creek	Patty Jones, DOI BLM, Challis Resource Office	Flow	November 2003

Appendix D. Distribution List

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Deanna Braun Bechtel	William Stewart Idaho Operations Office Environmental Protection Agency
Patty Jones, Hydrologist Challis Field Office Bureau of Land Management	Bart Gammet, Fisheries Biologist Lost River Ranger District Department of Agriculture Forest Service
Heath Hancock, Range Conservationist Idaho Department of Lands	Dan Kotansky, Hydrologist Idaho Falls Office Bureau of Land Management
Ivalou O'Dell, Information Specialist USGS Water Resources of Idaho	Water Quality Conservationist Idaho Association of Soil Conservation Districts
Seth Beal Butte County Commissioner	Harvey Walker Arco, Idaho
Dick Smith Lost River Hatchery	City of Mackay City Clerk
Richard May San Francisco, CA 94127	Greg and Cheri Webster Mackay, ID
Phil Coonts Hatchery Supt. Mackay State Fish Hatchery	Mark Stauffer Butte County Commissioner
John Traugher Butte County Commissioner	Leann & Dwayne Moates Arco, Idaho
James P. Fredericks, Regional Fisheries Manager Idaho Department of Fish and Game Upper Snake Region	Jim Gregory Mackay, ID 83251

Appendix E. Public Comments

Note: Comments are in normal type and responses are in **bold**.

EPA General Comments Received March 15, 2004

1) On Page 102 in the first paragraph, reference is made to the old EPA Gold Book suggested criteria for nutrients in streams, reservoirs and lakes. There are new nutrient criteria guidance available that are based on ecoregion numbers that you may want to check your data against. **The new suggested criteria are based on aggregate ecoregions that bisect the Big Lost River below Arco. The reach below Arco is not 303d listed. The upper river, represented by nutrient data in the TMDL, is covered under the Western Forested Mountains aggregate ecoregion. This aggregate ecoregion includes the Idaho Batholith, and the wetter northern Idaho/Northern Rockies ecoregion, which is a sterile granitic hydrology compared to the volcanic geology found in the Big Lost River above the sample points represented in the document. There are important differences between the Snake River Plain Ecoregion, to the south, that include lower precipitation and lower gradient watersheds. Idaho has not adopted numeric criteria because of the geologic differences between streams and watersheds. A single value for nutrient criteria does not work for the Big Lost River watershed due to varying geology, fragmentation of flowing water, and the absence of nuisance levels of aquatic plants in listed streams. Reference to EPA suggested criteria will be removed from the document and a reference to state narrative criteria will be inserted.**

2) On page 119, in Section 3.1, other sources of sediment are discussed, such as erosion from cultivated fields, mass wasting, irrigation return flows, roads, etc. It isn't evident in the document that any of these sources were analyzed for their contribution to the sediment issues in the streams. How was it determined that streambank erosion is the main source of sediment over all sources? Was there modeling done?

The Document identifies the primary source of sediment as streambank erosion. This was determined by evaluation of Land Use adjacent to listed reaches, field evaluation of potential sources; on the ground, in aircraft, and from aerial photos, and data submitted to DEQ. Based on field evaluation of potential sources and land use/ownership data it has been determined that sediment inputs are primarily related to rangeland grazing and the source is streambank erosion. TMDLs in this document are for streams adjacent to irrigated pasture and range and are primarily for temperature exceedance. It is stated that sediment TMDLs are in support of temperature TMDLs to improve channel geometry and riparian vegetation. Sedimentation is not identified as limiting beneficial uses in streams effected by temperature exceedances. Streams listed for sediment include the upper East Fork of the Big Lost River, Twin Bridges Creek, and Antelope Creek. Land use adjacent to these reaches does not include significant cultivated land, road issues, mass wasting or irrigation return flow. Other streams that had TMDLs prepared were not listed for sediment but had TMDLs for numeric exceedance of temperature criteria. Return flow from irrigation is minimal.

3) The first two sentences in the last paragraph on page 122 seem to be contradicting each other. You may want to rephrase what you are stating here.

The wording here will be made more clear that the primary source has been determined to be streambank erosion... and other potential sources include... and ultimately that the potential sources don't compare with the identified primary source.

4) On page 134 in the second paragraph, mention is made of road sediment using the WEPP model. WEPP is again discussed in Appendix G. I haven't been able to find any results or discussion on the use of this model anywhere else in the report. Was this an oversight?

WEPP, as explained in this section, is part of an erosion inventory process that is described as a whole in the Appendix. It was not specifically employed in any load allocations in the Big Lost River Watershed SBA/TMDL because there were no particular roads that were identified as major sediment sources to listed or impaired waters. It is not essential to the document, but it explains a method of evaluation and assessment that could be used if needed in the future.

5) On page 135, it appears that the wasteload allocations for the Lost River Hatchery and the Mackay Fish Hatchery have been set at zero. This means that they will not be allowed any discharge to the receiving water, period. This doesn't seem possible. While it is understood that there are BMPs either planned or in place for these facilities, they will certainly discharge something. You may want to reconsider this.

Discharge is in regard to solids, not flow. The intent is to reduce the discharge of solids to below detection limits (essentially zero discharge). There has been a litany of complaints about solids discharged into Warm Springs Creek from the Lost River Hatchery since at least 1997. The ranch immediately downstream has to use a suction dredge to remove hatchery sludge from the ditches and troughs on an annual basis. The current NPDES permit is based on the previous permit that should never have been approved by EPA because it didn't incorporate adequate settling capability in the settling pond to attain the discharge limit of 3.4 mg/L. EPA has been notified of the complaints, but has not been able to enforce the existing general NPDES permit after several inspections that should have identified the inadequacy of settling systems. Over the history of operation of this facility fine sediment has accumulated in the channel in sufficient quantities to impair cold water aquatic life, as evidenced by BURP results. Because this condition has been allowed to persist there is no remaining assimilative capacity to identify a lower discharge level that would be protective of water quality, salmonid spawning and coldwater biota. It will take time under very stringent discharge regulation to allow the spring creek to recover its proper function. The Waste Load Allocation will be set to the detection limit of 2 mg/l if that will facilitate EPA enforcement of the NPDES permit that they administer. With improved settling capacity to eliminate discharge of solids EPA will have a clearer threshold to enforce, and prevent further degradation of the stream channel and aquatic life.

DEQ has worked with the owner/operator and state Agriculture Department to design a settling pond with adequate efficiency to reduce discharge to less than detection limits. DEQ has applied, through EPA, for an implementation grant to enable the hatchery owner/operator to install the needed structure. EPA has rejected this grant and other funding sources will be sought.

6) There was no discussion of temperature in the wasteload allocations. If these receiving waters are impaired by temperature, they will need a wasteload allocation.

The riparian habitat adjacent to the hatchery is pristine. It has not been grazed in over 25 years. It serves as a reference condition for the stream below the hatchery. The mechanism to eliminate settleable solids from the stream is a settling pond that will be planted with woody species that will provide shade over time. The majority of temperature loading occurs below the hatchery on private land above the reservoir. Temperature loading in Warm Springs Creek is not identified as an impairment in the TMDL because fish can migrate to thermal refuge. The temperature TMDL is included only because of the exceedance of numerical standards during spawning periods. Temperature loading is minimal at the hatchery due to the flow and residence time of water. The waste load allocation will be set at the state temperature standard with the point of compliance at the hatchery effluent.

7) Even though it is stressed that streambank erosion is the primary source of sediment to the streams, load allocations should have been considered for other nonpoint sources of sediment such as cropland erosion, irrigation return flows, etc.

DEQ did consider load allocations for listed/impaired reaches based on existing/obtainable data, observed conditions and land use adjacent to listed reaches. Load allocations were based on erosion inventories that did not identify other significant nonpoint sources in relation to streambank erosion. Irrigation return flow to surface waters is practically nonexistent and cropland is minimal along listed reaches above the reservoir. Where irrigated pasture occurs adjacent to listed reaches the issue is streambank erosion not irrigation return flow.

8) In setting the load allocations for temperature found in Table 51, page 136, the highest recorded temperature was compared to the standard criteria and a load reduction was given, it seems a bit simplistic for a watershed of this size. More specific heat source identification and a load given in heat energy unit may have been appropriate.

Idaho temperature standards are not expressed in heat energy units. The TMDL is written to meet state water quality standards for temperature. Temperature based TMDLs take into account shading and channel geometry. Given the fragmented nature of flow in this watershed the scale of the watersheds where temperature load allocations were made is smaller than watersheds, like the Pahsimeroi River, that have been approved using the same methodology. This type of load allocation meets all of the TMDL requirements that have been set forth by EPA. Additionally, implementation efforts are a better use of heat loading in energy units to evaluate the effect of channel geometry and shade to guide selection of best management practices, particularly given the associated error of this methodology. DEQ feels it is important to retain that flexibility for Designated Management Agencies to determine implementation strategy based on available best management practices. Lack of coordination by EPA with federal land management agencies regarding TMDL responsibilities drastically limited the amount of time available to develop the temperature TMDLs. Federal agencies refusing to submit requested riparian and water quality data to hinder TMDL development is not a tactic that will be rewarded by DEQ.

BLM General Comments Received April 12, 2004

1) For mixed-ownership stream reaches with load allocations, expectations are unclear whether lands with Federal ownership will be expected to provide recovery similar to that which is expected of private land owners, or if greater efforts are expected on public lands.

Please refer to Section 313 of the Clean Water Act. It essentially says that federal agencies have to follow federal law...TMDL implementation is not optional for public land management agencies. TMDL implementation is on a voluntary and cooperative basis on private land. Federal land managers must meet state and federal water quality standards on land that they manage. In the few cases where BLM manages land downstream of private ownership it is apparent that water quality conditions at the upstream boundary are outside of the influence of the BLM management. Management here should foster optimal riparian conditions for streambank stability and solar shading to the extent possible. If it is determined through implementation monitoring that attaining prescribed load reductions is not possible due to loading on private land then the TMDL can be amended. This option would not be explored prior to implementation efforts on private and federal land by designated management agencies, which include the Soil Conservation Commission and the respective land management agencies.

Additional laws that govern federal land management include NEPA, Taylor Grazing Act of 1934, Federal Land Policy and Management Act of 1976, and The Public Range Lands Improvement Act of 1978.

2) The BLM suggests a subbasin-wide map of a larger scale. Due to the size of the subbasin, this may require a fold out page. The subbasin-wide map should also include general land ownership: National Forest, Public Lands, and private lands. Colors should be more distinct on the subbasin unit maps; on many maps the critical difference between blue and green is indistinct. Increased line width to identify items might be a better choice than closely related colors. The subbasin unit maps also need either township or range, or other locating device. From pages 16 through 61, pages 79 through 82, and page 107, seek to put the map figure on the same page as the description. The current spacing and page breaks in this section easily confuse the reader.

The subbasin-wide map of a larger scale that you refer to describes the BLM issued Surface Management Status maps. To re-create these maps is outside of the scale of this document. Perhaps BLM could supply 50 administrative copies of this map to distribute to readers. Description based on stream confluence is adequate to identify reaches that have load allocations. When BLM develops a specific Implementation Plan document then perhaps use of the Surface Management Status 30X60 minute quadrangle maps can be employed. Map figure references will be added to figures where needed.

3) The BLM questions whether an “additional margin of safety” (page 132 and 137) is appropriate in the assigned temperature load reductions.

A Margin of Safety (MOS) is required under the Clean Water Act for load allocations relating to particular pollutant loads. It is necessary to identify the margin of safety related to temperature standards, and the margin of safety related to temperature standards specific to spawning periods. The MOS identified as additional is still part of the overall margin of safety and helps assure that reasonable efforts will be made to meet temperature standards

during the transition into the spawning period when temperatures are warmest. In BLM's favor DEQ did not extend the spring spawning period until the middle of July for cutthroat, or begin the spawning period on the first of September for brook trout. Using the entire cutthroat spawning period could be an additional MOS that may be considered if implementation projects are not adequate to improve riparian conditions and channel geometry to effectively reduce stream temperatures.

4) Although the temperature TMDL criteria apparently is based on salmonids other than bull trout, the issue of whether or not bull trout are or were extant within the Big Lost subbasin was raised. While Bailey and Bond (1948) and Overton (1977) believe they identified bull trout or bull trout hybrids within the Big Lost system, researchers at the 2002 Sinks Symposium, including Bart Gamett of the US Forest Service, believe bull trout are not and were not extant in the Big Lost subbasin. Please refer to written comments on the Big Lost TMDL supplied by Bart Gamett regarding bull trout absence in the Big Lost.

The Forest Service did not submit comments on this TMDL. Citations of Bailey and Bond (1948) and Overton (1977) are of fisheries literature that has been published. In the Sinks Symposium Proceedings Dr. Robert Behnke of Colorado State University made the statement that based on records of distribution...only the shorthead sculpin *Cottus confusus*, mountain whitefish *Prosopium williamsoni*, and Paiute sculpin *C. beldingi* appear to be native to the Big Lost River. Dr. Behnke went on to say, however, that "Introductions by humans, deliberate and accidental, recorded and unrecorded over the past 120 years adds to the difficulty of any attempt to make a definitive determination of the native fish fauna of the Sinks Drainages.

In the process of listing bull trout as a threatened species the Fish and Wildlife Service did not include the Big Lost River watershed in its recovery plan or list of critical habitat because it was accepted that bull trout were not currently present in the Big Lost watershed. DEQ will add the paraphrased statement by Dr. Behnke, and the FWS designation to the fisheries section of the Big Lost River Subbasin Assessment and TMDL. DEQ is not trying to make a case one way or the other, but simply citing available literature and submitted data.

5) In the unit description of the Upper Big Lost River page 27, it is noted, "Grazing occurs throughout the Subbasin with no identifiable riparian-directed grazing management or best management practices on public or private land." Since mid-1997, Public Lands grazing activities in Idaho have been required to comply with the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management. Challis Field Office Resource Management Plan (1999) standards are applied to grazing permits through the NEPA process. While drought has been a serious problem for three of the six summer seasons since the Standards and Guides were issued, rangeland practices have made improvements on Public Lands riparian areas in the Big Lost subbasin.

While compliance with the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management, the Challis Field Office Resource Management Plan, and the NEPA process imply rangeland management improvement there is no specific consideration given to riparian management or water quality concerns beyond residual stubble height. Stubble height management has not been shown to be a meaningful recovery

strategy when applied to areas already over utilized. Guidelines for riparian recovery identify resting periods in excess of the period of time since mid-1997. Observations during the development of this subbasin assessment revealed numerous areas that were not in compliance with residual stubble height standards. Numerous areas observed left residual forage below the standards that you cite. Additionally, no data was submitted to demonstrate the recovery referred to as improved grazing practices. It does not appear that drought conditions have altered grazing practices for the purpose of improving riparian conditions, though possibly for reducing degradation of rangeland conditions.

6) The description of Chilly Slough on page 32 should also address the cooperative habitat conservation efforts of The Nature Conservancy, Idaho Fish and Game, the BLM, US Fish and Wildlife Service, Rocky Mountain Elk Foundation, and Ducks Unlimited in Chilly Slough. Public lands in the Chilly Slough area are managed for wildlife and recreation. Wetland fencing is an important part of management of Public Lands in Chilly Slough.

DEQ sent information request letters to all of the agencies you mention including The Nature Conservancy in November 2002. The type of information that you provide in your comment was specifically requested of each of the agencies. No information was provided related to Chilly Slough or cooperative habitat conservation efforts or pollution control efforts.

7) The description on page 38 of recreation opportunities on Public Lands at Mackay Reservoir should be changed to reflect the following: The BLM manages one campground and no boat ramps at Mackay reservoir.

This change will be made to the document.

8) On page 53, the description of the White Knob Mining District should also include mention of historic mining on Public Lands in the area.

Historic mining practices on public lands in the White Knob mountains is mentioned under the Geology section, in the History section and the last sentence in the second paragraph on page 53.

9) The discussion on page 64 of Big Lost history should mention the beaver eradication policy of the Hudson Bay Company in contested areas such as east central Idaho. The complete removal of beaver by HBC and the Missouri Fur Company in the early 19th century would have had severe impacts on streams in the Big Lost. The “little took place”, describing the time period between the trapping era in the Big Lost and the advent of settlers and miners, should be removed. Lewis and Clark explored Idaho but did not “discover” Idaho.

The severe impacts to streams come from elevated sediment supply combined with the lack of beaver. During the period of market trapping sediment supply would have been considered at levels of natural background prior to exacerbation of sediment supply from grazing, mining, cultivated agriculture, urban development and timber harvest. These are the severe impacts to streams that precipitate the statement that “little took place” during the period following Lewis and Clark’s exploration and subsequent development of market fur trade. The discussion of history refers to the discovery of the area by Lewis and Clark, not the outward discovery of the area. The Lewis and Clark expedition was referred to as the Corps of Discovery. It’s relative. They gave Euro-Americans the first descriptions of many plants, animals, birds, rivers, and what the Rocky Mountains were like. Some animals discovered include grizzly bears, bison (which had lived in the east long before), prairie dogs, bighorn sheep, pronghorn antelope, magpies, Clark's nutcracker and

Lewis's woodpecker. Plants discovered include bitterroot, camas, and wapato, all root vegetables that Indians used as easterners used potatoes. The captains also made careful notes about the Indian nations they met, describing how they lived and some of their beliefs, along with some of their language.

10) On page 66, in the discussion of land use, please add that 16% of the subbasin is Department of Energy land. Viewing the map of land ownership on page 67 it appears that private lands are greater than 2% of the subbasin. Please check this figure.

Land ownership within the Big Lost River watershed was calculated by the University of Idaho from established GIS coverages, and private land actually represents 1.7%, but for the convenience of the reader is rounded up to 2%. It is shown on the map and stated in the text and in Table 5 that the Department of Energy ownership is 16%. Land ownership is delineated by Landowner (Private and Public), acres, sq. miles, sq. Km, and percent of total in Figure 5. Land use within the DOE land incorporates rangeland as well as facilities. This will be added to the text on page 66.

11) In the discussion on page 77 of existing water quality data please include mention of BLM's riparian monitoring: stubble height, greenline, lotic and lentic functionality, woody browse, and streambank alteration. BLM uses these data to determine when livestock movement from one location to another should occur.

BLM did not submit any of this data to DEQ to be included in the document. DEQ requested this data in a letter to the BLM Hydrologist in the BLM Challis office on November 22nd 2002. Follow-up discussions about the Data Request Letter and TMDL development after the letter was sent did not result in submission of the data that you refer to above to DEQ.

12) On page 84, the Figure 71 description does not match the title on the graph. There is also no narrative for this graph.

The description will be changed to show that the data is from the gage just above the Reservoir.

13) In the section on Water Column Data, pages 87 through 102 please note what the yellow highlighting identifies. Please also identify which data were measured on the ground and which were inferred from infrared aerial photos. For charts noting "spring" and "fall" data collection, please give the actual dates of data collection.

Text will be added to show that the yellow highlighting identifies exceedance of water quality standards for temperature in 10% or more of the observances. There was no data inferred from infrared aerial photos. There is no mention of use of infrared aerial photos for interpreting temperature in the document. Forward Looking Infrared temperature data was collected, but was not used in setting temperature loads. The actual dates of data collection are identified for spring and fall under the column titled Sample Period.

14) On page 101, nutrient data was identified as being collected "at the same time" as the water column metals data, but the dates in the tables do not reflect this.

Table 32 is titled USGS water column data pertaining to water quality from 1996. This table matches Table 36 that is titled USGS water column data pertaining to nutrients from 1996.

The dates match for each sampling event. The same is true of table 33 and 37. The wording: “at this location” will be replaced by “The Howell Ranch” on page 101.

15) On Table 41, page 104, please spell out the names of the ranches.

Ranch names will be included in the table: LR Ranch is Lost River Ranch, BR is Broken River Ranch, and F Ranch is Freeman Ranch.

16) The use of the word “erosive”, as used on page 105, should not be used to mean “erodible”. “Erosive” denotes a quality of an agent of erosion, where “erodible” describes a quality of a material being eroded.

Erosive will be changed to erodible in this application of the term on page 105, top paragraph.

17) Page 107 through 112: The bar colors do not match the legend colors on some of the fish frequency histograms.

This is an artifact of printing we will watch for this when the final document is printed. Reference to the fish data in the text, combined with the different patterns retains the full information in these figures.

18) On page 115, the numbers look too high for two flow measurements of Twin Bridges Creek, Table 51. Are flows on all the tables in units of cfs?

Those flows are correct as written on those dates for those locations. June 21, 1995 can often be during the peak of spring runoff. The units are cfs and the tables will be edited to reflect this.

19) Regarding reference to Thousand Springs Creek riparian grazing on page 118: Are the mentioned degraded conditions south of Chilly Slough? Public Lands along Thousand Springs Creek within the slough area are fenced to exclude livestock and are not within a grazing allotment.

The text discussion describes conditions below Trail Creek Road, and Below Chilly Slough, as stated. That would be south of Chilly Slough. No pollution prevention data such as riparian fencing or monitoring was provided to DEQ by BLM as a result of the data request submitted to the BLM hydrologist in Challis. The season-long wetland/wet meadow grazing observed in both years during the development of the Subbasin Assessment must have occurred on private land, according to your comment.

20) On page 122,-second paragraph: Please note that the BLM does monitor riparian condition on streams within allotments and uses those data to guide management of riparian grazing.

Noted. See 3rd sentence in comment response 19.

21) On page 124, the table needs footnotes to explain the abbreviations used in the Effluent column.

The abbreviations and acronyms used in Table 55 on page 124 are described in the Abbreviations, Acronyms, and Symbols section on page xiii in the front of the document with the exception of: d (day) mo (month). These abbreviations will be added to this section. TSS is covered in the Glossary section on page 163. Colony Forming Units (cfu) will be added to the glossary under the definition for coliform bacteria and to the list of abbreviations and acronyms.

22) In the Data Gaps section, pages 125 through 126, there are comments that are not specific to identification of data gaps. Please either delete the comments or provide citations for the comments made in this section.

This statement is intended to demonstrate that lack of assimilated riparian data is not considered a data gap. Data has been collected on streams managed by the Forest Service, but not analyzed, and/or not used to guide management, or data was not submitted when requested. Yet grazing in riparian habitat that is already degraded continues as if data were actually used to guide management. The erosional conditions that were observed in the development of this document can not be said to be improving, nor can it be said that riparian management is guided by data. Not using available data does not constitute a data gap.

23) The BLM has programs to monitor streambank stability and instream temperature. However, McNeil core sampling of subsurface sediment has not been part of our monitoring protocol. The BLM protocol for monitoring instream sediment is the modified pebble count described in Bauer and Burton (1993), which is less disturbing to the substrate. It is unclear whether, as part of IDEQ's TMDL requirements on page 131, the BLM is being instructed to monitor subsurface sediment through the use of a McNeil protocol. Please clarify.

DEQ and the Forest Service monitor subsurface sediment because it is a direct indicator of spawning success (or egg/fry mortality). There is no correlation between surface fines monitored by Wolmann Pebble counts and subsurface sediment monitored by McNeil sediment core samples. Surface fines may give an indication of cobble embeddedness, however to truly evaluate potential for spawning success in salmonid species temperature and subsurface fine sediment must be examined. Disturbance of substrate on the scale of the McNeil sediment core sampling methodology (12 inch diameter X 4 inches deep X 3 replicates) is minimal and inconsequential to the wellbeing of the stream compared to the data that it renders about the effectiveness of land management. It should primarily be used in monitoring that will follow implementation of BMPs that are identified in the Implementation Plan that will be developed by federal land management agencies as required by the federal Clean Water Act. BLM may opt to not use McNeil sediment core sampling to demonstrate BMP effectiveness, but it will be inconsistent with other monitoring and should be justified in the BLM Implementation Plan.

24) On page 131 IDEQ states, "An adaptive management approach will be used to provide reductions in sediment loading based on best management practice (BMP) implementation coupled with data from monitoring to determine the loading rate at which beneficial uses are supported." What is the estimated timeframe on this adaptive management process?

An Implementation Plan document will be required within 18 months of approval of the TMDL. The Implementation Plan will identify Best Management Practices that will be initiated by land management entities to effect temperature and sediment load reductions. Implementation is expected to be completed within 10 years of TMDL approval. Implementation monitoring will be conducted as outlined in the Implementation Plan, and will show reduction of pollution loads and status of Beneficial Use Support and compliance with numeric water quality standards. The timeline for restoring beneficial uses will depend upon the adequacy of the Implementation Plan but should not exceed 15 years from completion of implementation projects. Implementation monitoring will determine if implementation projects are adequate to restore beneficial uses, as stated on page 131, and compliance with numeric water quality standards.

25) It is not clear what is indicated by the “implicit margin of safety” and the “additional implicit margin of safety” identified on page 132, and the “additional margin of safety” identified on page 137.

The Margin of Safety can be explicit, such as an additional 5% reduction from the load capacity, or it can be implicit, such as selecting the highest observed temperature during the evaluation period to set the load reduction. Margin of Safety is cumulative and explicit or cumulative and implicit. MOS can be compounded to achieve an additional MOS. The MOS is required in the federal Clean Water Act and must demonstrate that uncertainty in the load allocation is compensated for to insure restoration of beneficial uses.

26) The table on page 136 would be clearer if there was a column identifying “Tons per mile per year”.

EPA requires that the current load be explicitly stated. Tons per mile per year for each of the loads identified in the table on page 136 appear in table 61 on page 141. This representation of the erosion rate facilitates comparison between reaches and between reductions.

27) Seasonal variation as calculated by WEPP from the 30-year climatic and hydrologic events, discussed on page 138, represents an average year’s runoff and sediment delivery. The 30-year climatic and hydrologic record, however, does not include the full range of potential events, and modeling based solely on these data would give a rate that is substantially less than the actual erosion rate. The probability distribution of sediment delivery is skewed to the right, with infrequent large events that are orders of magnitude greater than frequent events.

In cases where greater than 30-year climatic data is available for affected reaches it would be used. However, if sediment load reduction is optimized for the 30-year event it is likely that the overall load reduction would be adequate to effect a dramatic reduction in sediment loading. Perhaps when BMPs are adequate to address the 30-year probability curve there will be sufficient improvement to assess whether the 50-year probability is significant.

28) In the “Reserve” section on page 138 the phrase “within a reasonable time” is mentioned in reference to the non-attainment of full beneficial use. Please define the timeframe.

Please refer to the response to comment 24 above.

29) Research papers that are mentioned in the text but not listed in the References Cited, pages 144 through 146, are: Overton et al (1995), Hubbs and Miller (1948), and Bailey and Bond (1963). **Those references will be added to the Literature Cited section.**

Non-Agency Comment on Big Lost River Subbasin Assessment and TMDLs Received 2/29/04

In my opinion, there has not been enough data for a long enough time period to suggest Total Maximum Daily Loads should be imposed upon any of the Big Lost River Drainage. Most of the temperature data has been obtained only for the last couple of drought years, and of course the temperatures have been higher. If the data were correlated to % of normal precipitation for the year, I think it might be revealed that during "normal precipitation" years, the temperatures are acceptable. During drought years, the riparian areas are hit just as hard as the surrounding areas, and vegetation dries up and dies, just as the vegetation throughout the valley has done! I have lived in this valley for 18 years now, and we have been mostly in a drought cycle that time, with only a few years out of 18 with "normal" precipitation, and even then there have been "floods". The valley has had a tough time for this entire period, and imposition of administrative rules to try to control stream bank erosion, when it really has been "nature" itself to blame does not provide benefit to anybody or anything.

Temperature data includes data from 1999. Figure 1 shows the relative precipitation summary from 1996 through 2003. There was some spawning temperature exceedance in 1999, which had the highest precipitation of the 5 most recent years. The TMDL court settlement does not provide for sampling only during the most optimistic years, and TMDLs do not include data in exceedance of the 10 year 90th percentile of climatic maxima. Riparian vegetation condition and channel geometry should be adequate to buffer stream temperatures in years with above average temperature and below average precipitation if these areas are properly managed. There is no evidence that riparian management has been given increased consideration by land management agencies during periods of climatic extremes to offset impacts to water quality.

Use of the terms, "over allocated" and "overgrazed" with regard to water resources and cattle numbers is subjective and inflammatory, since nobody can predict the amount of water or grass available during these drought years.

Over allocation and overgrazing have been well documented in this watershed for many years. Evaluation of streambank conditions show this.

Fish populations remain at "fishable" levels primarily due to hatchery planting. Adding screens across diversions would obviously help with fish numbers, but almost certainly would not be cost effective. The only "true" native fishes in the Big Lost River are the mountain whitefish and the sculpin, so all the fish studies are for introduced fish species, anyway. There is a reason there historically were no trout, they cannot make it in this drainage without human intervention.

TMDL regulations require protecting fishery resources that were in place in the late 70's (November 1975). There are self sustaining populations of salmonids in the watershed, and it is clear that there could be improvement in fisheries resources with improved land management. Relying on planted fish to sustain fisheries is not cost effective or desirable.

I am in favor of doing what we reasonably can to maintain and improve our valley and in particular our river and streams, but we need to make sure we don't create more economic problems than we solve. Fencing cattle away from stream banks is always helpful to the riparian areas, but fences are expensive and wildlife like the streams as well, and can sometimes be even worse than cattle.

There are grants available to implement best management practices that require minimal cost sharing. TMDL implementation is voluntary on private lands. Areas in the Big Lost River where wildlife have had a comparable impact on riparian vegetation or streambank stability on a scale observed from other land management uses have not been identified.

Appendix F. BURP and Fish Data

Big Lost River Subbasin Assessment and TMDL

Streams in the Big Lost River watershed that are perennial are presented for their relevance to fisheries and water quality. Water quality data that is available for evaluation in this subbasin assessment includes Beneficial Use Reconnaissance Project data collected by the Idaho Department of Environmental Quality. Scores are in SMI and SHI format where available, otherwise are presented in the older MBI and HI format. Temperature data and fisheries data collected by the Forest Service, and fisheries data collected by the Idaho Department of Fish and Game are also presented. The objective of evaluating the data is to determine if streams are fully supporting designated or existing beneficial uses that include coldwater aquatic life and salmonid spawning. Streams that are ephemeral or have flow less than 1 cfs throughout the year are not evaluated as part of the Subbasin Assessment or with regard to narrative water quality standards.

East Fork Big Lost River BURP and Fish Data

East Fork Big Lost River BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
300 m above N. Fk. Big Lost River		N/A	N/A	Too High to Sample	8/1/95
1.75 mi. above Wildhorse		N/A	N/A	56.4	8/14/01
At Confluence of Starhope		N/A	N/A	Too High to Sample	7/31/95
400 m above Corral Cr.	039_03	1	1	33.26	7/3/95
1 mi. above Smelter Canyon Cr.	039_02	0	3	49.08	7/5/95

East Fork Big Lost River Fish Data: 8/13/03 1 mi. above Smelter Canyon Cr. confluence (just below Swamps)

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	96	100	167.8	50	275
Cutthroat					
Other					

East Fork Big Lost River Fish Data: 8/13/03 above Burma Rd. Bridge

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	33	17.6	264.5	130	330
Brook	154	82.4	120.1	45	285
Cutthroat					

East Fork Big Lost River Fish Data: 8/13/03 1 mi. below Starhope Creek (overlapping Fox Cr. confluence)

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	5	22.7	286.0	165	300
Brook	14	63.7	152.1	65	210
Cutthroat	3	13.6	430.0	210	410
Other					

Big Lost River Subbasin Assessment and TMDL

East Fork Big Lost River Fish Data: 8/13/03 0.5 mi. above Willow Creek (below private inholding)

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	34	81	173.7	110	255
Brook	7	17	182.9	140	215
Cutthroat	1	2	335.0	335	335
Other					

Anderson Canyon Creek BURP Data: 2nd Order

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
At Antelope Pass Road	039_02	1	1	0.07	7/17/96
At Antelope Pass Road	N/A	N/A	N/A	Dry	8/7/01

Fish Data: 7/10/1996

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1		189	189	189
Brook	4		210.25	174	271
Cutthroat					
Other					

Newton Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
¼ mi. above E. Fk. Big Lost River	033_02	3	1	0.32	7/1/98

Coal Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
At Copper Basin Rd.	039_02	3	1	0.42	7/1/98

Coal Creek Fish Data: 7/8/1996

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	35	100	107.7	32	206
Cutthroat					
Other					

Cabin Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
Upstream of FS Rd 142 Bridge	040_02	2	1	4.81	7/18/96
Upstream of FS Rd 142 Bridge	N/A	N/A	84	3.76	7/1/98

Big Lost River Subbasin Assessment and TMDL

Cabin Creek Fish Data: 7/15/1996

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	46		88.1	71	208
Brook	43		107.6	67	246
Cutthroat					
Other					

Pole Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
.3 mi above confluence	02	2	1	0.431	9/12/96

Pole Creek Fish Data: Pole Creek. No fish collected

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook					
Cutthroat					

Deer Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
0.1 mi above E.Fk Rd.	02	3	1	0.43	9/12/96

Deer Creek Fish Data: 7/7/97

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	10	100	148.8	69	207
Cutthroat					
Other					

Rider Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
0.35 miles above E. Fk. Road	02	3	1	0.387	9/12/96

Rider Creek Fish Data: 7/7/97 No Fish Collected

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook					
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

Little Boone Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	Habitat Score	Flow (cfs)	Date Sampled
1 m above E. Fk. Rd.	N/A	N/A	N/A	.043	8/13/01
0.4 mi above E.Fk. Rd.	N/A	0	1	0.44	7/17/96

Little Boone Creek Fish Data: 7/7/97 No Fish Collected

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook					
Cutthroat					
Other					

Boone Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
Not Assessed					

Boone Creek Fish Data: 7/22/97

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	8	72.73	157	82	205
Brook	3	27.27	109.3	53	149
Cutthroat					
Other					

Boone Creek: East Fork BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
Not Assessed					

East Fork Boone Creek Fish Data: 7/22/97

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	1	3.7	200	82	205
Brook	3	96.29	67.6	35	212
Cutthroat					
Other					

Fox Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
0.65mi above E.Fk. Rd.	034_02	3	1	2.29	7/17/96
1m above E.Fk. Rd.				0.07	8/13/01

Big Lost River Subbasin Assessment and TMDL

Fox Creek Fish Data: 7/8/96

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	2	66	143	130	157
Brook	1	33	164	164	164
Cutthroat					
Other					

Road Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
	02	1	1	0.26	7/17/96

Road Creek Fish Data: No Fish Data: Road Creek

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook					
Cutthroat					

Star Hope Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
At Bear Cr.		4.62	102	3.3	7/12/94
At Ramey Cr.		4.29	82	31.8	7/13/94
At Broad Canyon Cr	N/A	N/A	N/A	14.8	8/13/01
At Ramey Cr.	N/A	N/A	N/A	22.7	8/20/01

Star Hope Creek Fish Data: Date: 7/18/96 2.9 mi. above Copper Basin Loop Rd on Starhope Canyon Rd.

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	3	100	212	206	222
Cutthroat					
Other					

Star Hope Creek Fish Data: Date: 7/18/96 0.6 mi below Starhope Campground

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	3	100	103.3	83	137
Cutthroat					
Other					

Star Hope Creek Fish Data: Date 8/14/03 0.6 mi below Starhope Campground

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	147	91	129.3	49	222
Cutthroat	14	9	277.5	93	369
Other					

Big Lost River Subbasin Assessment and TMDL

Star Hope Creek Fish Data: Date 8/14/03 Above Cow Camp 1.25 mi.

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	1		240	240	240
Brook	155		169.5	110	245
Cutthroat	13		286.5	225	415
Other					

Star Hope Creek Fish Data: Date 8/14/03 0.25 mi above East Fork Road

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	5	83	250	200	290
Brook					
Cutthroat	1	17	300	300	300
Other					

Ramey Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow (cfs)	Date Sampled
0.6 mi. above Forks	035_02	4.25 (MBI)	95 (HI)	1.17	7/16/96
50 m below lowest trib.	035_02	3	2	5.1	7/16/96
1 mi. above Copper Basin Rd.		N/A	N/A	1.5	8/7/01

Bellas Canyon Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
2 mi. up Rd.	035_02	3	3	6.8	7/16/96

Bear Canyon BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
100 m above Starhope Campground	036_02	2	3	4.4	7/17/96
At Copper Basin Rd.		N/A	N/A	0.7	8/8/01

Bear Canyon Creek Fish Data: DEQ data:

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	10	100	147.9	90	229
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

MuldoonCreek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
300 m above Green Lake outlet	037_02	3	1	5.74	7/12/94
40 m above Muldoon Canyon Rd.	037_02	3	1	11.67	7/12/94
At Copper Basin Loop Rd.				9.49	8/8/01

MuldoonCreek Fish Data: Date: 7/17/96 300 m above upper Right Fork of Muldoon Creek

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	28	100	114.42	29	185
Cutthroat					
Other					

MuldoonCreek Fish Data: Date: 7/25/96 . 100 m above Copper Basin Loop Rd.

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	41	100	129.2	42	223
Cutthroat					

Broad Canyon Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
25 m below trail head	036_02	3	1	28.1	7/15/96

Lake Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow	Date Sampled
250 m above Copper Basin Rd.	038_02	3	2	20.8	7/15/96
At Copper Basin Rd.				3.6	8/8/01

Lake Creek Fish Data: 7/16/96 .3 mi below Copper Basin Loop Rd.

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	79	100	97.5	27	279
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

Lake Creek Fish Data: 7/16/96 300 m above trailhead

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	40	100	150.4	31	230
Cutthroat					
Other					

Lake Creek Fish Data: 8/6/97 lower meadow

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	35	100	113.6	38	190
Cutthroat					
Other					

Lake Creek Fish Data: 8/5/97 above Rough Lake

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	35	100	113.6	38	190
Cutthroat					
Other					

Steve Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
At Copper Basin Road	039_02	0	2	3.51	7/2/98

Steve Creek Fish Data: Date 7/10/96

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	5	100	166.6	145	194
Brook					
Cutthroat					

Wild Horse Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
Left Fork above confluence	031_02	1	1	1.5	9/11/96
100 m above Fall Cr. Bridge	031_02	1	1	23.7	7/13/94
100 m above Fall Cr. Bridge		N/A	N/A	15.35	8/14/01
0.25 mi below forks	031_02	2	1	14.8	7/13/94

Big Lost River Subbasin Assessment and TMDL

Wild Horse Creek Fish Data: 7/12/96 1.1 mi. above campground

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	7	100	125.6	20	278
Cutthroat					
Other					

Wild Horse Creek Fish Data: 7/12/96 1.8 mi. above campground

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	3	100	205	166	255
Cutthroat					
Other					

Wild Horse Creek Fish Data: 7/15/96 1 mi. above guard station at Burnt Aspen Creek.

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook	1	100	150	150	150
Cutthroat					
Other					

Wild Horse Creek Fish Data: 8/14/03 above campground

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	1	1	195	195	195
Brook	75	99	115.2	45	260
Cutthroat					
Other					

Wild Horse Creek Fish Data: 8/14/03 above guard station at Burnt Aspen Creek

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	4	50	216.25	130	260
Brook	4	50	176.25	140	205
Cutthroat					
Other					

Bailey Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
500 m above Wildhorse Rd.	030_02	1	1	4.23	7/1/98

Burnt Aspen Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
500 m above Wildhorse Rd.	030_02	3	3	4.23	7/1/98

Big Lost River Subbasin Assessment and TMDL

Burnt Aspen Creek Fish Data: No Fish Collected

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow					
Brook					
Cutthroat					
Other					

Fall Creek BURP Data:

BURP Site Location	Assessment Unit	MBI Score	HI Score	Flow (cfs)	Date Sampled
0.35 mi. above Wildhorse Rd.	032_02	4.26	90	9.5	9/11/96
0.35 mi. above Wildhorse Rd.	032_02	N/A	N/A	21.8	8/14/01

Fall Creek Fish Data: 7/24/96 below forks

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	2	100	164	50	278
Brook					
Cutthroat					
Other					

Fall Creek Fish Data: 7/24/96 below first bridge on Moose Lake trail

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	1	25	167	167	167
Brook	3	75	209.3	170	243
Cutthroat					
Other					

Fall Creek Fish Data: 8/14/03 0.25 mi. above Wildhorse Creek

Species	Total Captured	Percent Composition	Mean Length(mm)	Minimum Length(mm)	Maximum Length(mm)
Rainbow	7	35	206.4	130	260
Brook	13	65	173.1	80	235
Cutthroat					
Other					

North Fork Big Lost River BURP and Fish Data

North Fork Big Lost River BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.25 mi below Hunter Cr.	027_02	3	2	2.3	9/10/96
0.25 mi above Hunter Cr.	027_02	4.41 (MBI)	112 (HI)	4.7	9/10/96

Big Lost River Subbasin Assessment and TMDL

North Fork Big Lost River Fish Data: 11/27/96 at mouth of Squib Canyon

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	5	100	149.4	82	205
Cutthroat					

North Fork Big Lost River Fish Data: 11/27/96 .65 mi. above Jim Canyon

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	4	17.4	219.25	202	244
Brook	19	82.6	121.16	73	87
Cutthroat					
Other					

North Fork Big Lost River Fish Data: 7/30/96 1 mi. above Hunter Creek at Road crossing

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	6	100	143.7	68	215
Cutthroat					
Other					

North Fork Big Lost River Fish Data: 8/13/03 mouth of Squib Canyon

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	7	165	165	165
Brook	13	93	130	60	215
Cutthroat					
Other					

North Fork Big Lost River Fish Data: 8/13/03 .25 mi. below Burnt Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	7	24	152	120	240
Brook	22	76	140	70	210
Cutthroat					
Other					

North Fork Big Lost River Fish Data: 8/13/03 0.25 mi. above Deep Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	13	59	156.5	55	285
Brook	9	41	120.5	75	175
Cutthroat					
Other					

Bartlett Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
Just Above Forest Rd	027_02	N/A	127 (HI)	19.69	7/1/98

Big Lost River Subbasin Assessment and TMDL

Bartlett Creek Fish Data: 8/5/96 just above forest road

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	19	100	90.6	34	165
Cutthroat					
Other					

Bartlett Creek Fish Data: 8/11/97 1 mi above N. Fk. Rd. No Fish Collected

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Bear Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
100 m above Squib Rd	027_02	2	3	1.37	9/4/96

Chicken Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
300 m above N. Fk. Rd..	027_02	3	1	0.8	8/27/96

Chicken Creek Fish Data: 7/31/96 450 m above N. Fk. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	3	37.5	116	72	171
Brook	5	62.5	158	116	207
Cutthroat					
Other					

Corral Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
700 m above N. Fk.	027_02	2	2	0.41	9/4/96

Corral Creek Fish Data: 8/2/96 250 m above N. Fk.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	1	100	201	201	201
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

Grasshopper Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.2 mi above N. Fk. Rd.	027_02	3	1	0.34	8/26/96

Grasshopper Creek Fish Data: 7/30/96 150 m above N. Fk. Rd. No Fish Collected

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Horse Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.1 mi. above N. Fk. Rd.	027_02	3	1	0.51	8/26/96

Horse Creek Fish Data: 7/30/96 300 m above N. Fk. Rd. No Fish collected

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Hunter Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.2 mi. above N. Fk. Confluence	027_02	2	2	.49	9/5/96

Hunter Creek Fish Data: 7/30/96 0.2 mi. above N. Fk. confluence

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	3	100	85	81	91
Cutthroat					
Other					

Miller Canyon Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
Near Headwaters	027_02	3	1	1.2	8/27/96
0.2 mi above N. Fk. Confluence	027_02	3	1	2.38	8/27/96

Big Lost River Subbasin Assessment and TMDL

Miller Canyon Creek Fish Data: 300 m above N. Fk. Big Lost River

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	25	295	295	295
Brook	3	75	129.6	98	171
Cutthroat					
Other					

Park Canyon Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.25 mi. above N. Fk. Rd.	027_02	3	1	1.46	8/26/96

Park Canyon Creek Fish Data: 7/31/96 above 1st culvert on FS Rd. 043 70 m below N. Fk. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	2	100	77	39	115
Cutthroat					
Other					

Slide Canyon Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.1 mi. above N. Fk. confluence	027_02	3	1	0.31	9/4/96

Slide Canyon Creek Fish Data: 7/31/96

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	50	272	272	272
Brook	1	50	163	163	163
Cutthroat					
Other					

Toolbox Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.1 mi. above N. Fk. confluence	027_02	3	2	0.44	8/26/96

Toolbox Creek Fish Data: 7/31/96 300 m above N. Fk. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	5	100	50.4	46	55
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

Squib Canyon Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.1 mi. above N. Fk. confluence	027_02	3	3	0.7	9/4/96

Squib Canyon Creek Fish Data: 8/2/96 15m above FS Rd. 601

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	8	100	156.6	115	201
Cutthroat					
Other					

Summit Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
100 m above Park Creek Rd.	028_02	3	1	2.2	9/6/96
100 m above Big Fall Cr.	028_03	3	1	6.2	9/6/96
0.2 mi. below Phi Kappa Cr.		N/A	N/A	4.7	8/7/01
0.25 mi above Kane Cr.	028_03	3	1	7.9	9/10/96

Summit Creek Fish Data: 8/5/96 at trailhead near summit

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	8	100	152.1	116	185
Cutthroat					
Other					

Summit Creek Fish Data: 7/25/96 2.5 mi. above Kane Cr.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	35	100	134.1	52	214
Cutthroat					
Other					

Summit Creek Fish Data: 7/25/96 210 m above Big Fall Cr.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	98	100	114.8	33	197
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

Summit Creek Fish Data: 8/13/03 0.1 mi. below Phi Kappa Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	9	45	164.4	110	230
Brook	106	55	139.6	50	250
Cutthroat					
Other					

Phi Kappa BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.2 mi. above Summit Cr.	028_02	3	2	0.65	9/5/96

Phi Kappa Fish Data: 8/11/97 No Fish Collected.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Kane Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
1 mi. above Summit Cr.	029_02	2	1	7.8	9/11/96

Kane Creek Fish Data: 7/26/96 1 mi. above Summit Cr.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	2	20	231	212	250
Brook	8	80	109.1	44	182
Cutthroat					
Other					

Kane Creek Fish Data: 7/9/97 70 m above Rt. Fk.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	2	100	72	29	115
Cutthroat					
Other					

Kane Creek Fish Data: 8/13/03

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	2	4.5	190	170	210
Brook	42	95.5	124.4	45	230
Cutthroat					
Other					

Big Lost River Subbasin Assessment and TMDL

Little Kane Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
100 m above Kane Cr.	029_02	3	2	21.08	7/1/98

Big Fall BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.2 mi. above Trail Cr. Rd.	028_02	3	1	1.7	9/12/96
5m above Trail Cr. Rd.		N/A	N/A	06.6	8/6/01

Big Fall Fish Data: 8/5/96 0.175 mi. above rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	12	100	100.5	31	161
Cutthroat					
Other					

Little Fall Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.55 mi up Little Fall Cr. Rd	028_02	3	2	1.4	9/5/96
At rd xing				Dry	8/6/01

Upper Big Lost River BURP and Fish Data

Upper Big Lost River BURP Data: No BURP Data Available.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled

Upper Big Lost River Fish Data: Date 0.1 mi above Burnt Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	32	65	158	95	275
Brook	5	10	136	75	230
Cutthroat	4	9	297	295	300
White Fish	8	16	N/A	N/A	N/A

Burnt Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
150 m above Trail Cr. Rd.	025_02	2	2	2.73	6/30/98

Big Lost River Subbasin Assessment and TMDL

Burnt Creek Fish Data: 0.9 mi. above Trail Cr. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	100	172	172	172
Brook					
Cutthroat					
Other					

Twin Bridges Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
Just below middle tributary	026_03	0	1	30.74	6/21/95
At Trail Cr. Rd.		N/A	N/A	No Flow	8/20/01
At Trail Cr. Rd.	026_03	0	1	47.2	6/21/95
At Trail Cr. Rd.	026_03	2	1	0.37	7/14/94

Twin Bridges Creek Fish Data: 6/20/96 immediately below Trail Cr. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	6	54.5	127.3	78	196
Brook	5	45.5	143	103	193
Cutthroat					
Other					

Pinto Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
100 m above Trail Cr. Rd.	024_02	1	3	3.93	6/30/98

Pinto Creek Fish Data: 7/23/96 1.05 mi. above Trail Cr. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	8	100	115.4	74	189
Brook					
Cutthroat					
Other					

Rock Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
FS Rd 603 xing	024_02	0	1	0.03	7/14/98

Big Lost River Subbasin Assessment and TMDL

Garden Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
220m above Trail Cr. Rd.	025_02	0	1	0.79	6/30/98

Garden Creek Fish Data: 8/11/97 No fish collected

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Lake Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
300 m above Trail Cr. Rd.	025_02	2	1	0.265	6/30/98

Deep Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
60 m above Big Lost	025_02	1	3	1.31	6/30/98

Burnt Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	MBI Score	Habitat Score	Flow	Date Sampled
150 m above Trail Cr. Rd.		2.77	90	2.73	6/30/98

Burnt Creek Fish Data: 8/11/97 0.9 mi. above Trail Cr. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	100	172	172	172
Brook					
Cutthroat					
Other					

Bartlett Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	MBI Score	Habitat Score	Flow	Date Sampled
500m above Big Lost confluence		3.18	127	19.69	7/1/98

Big Lost River Subbasin Assessment and TMDL

Bartlett Creek Fish Data: 8/5/96 Just above Forest Rd. 444

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	19	100	90.6	34	165
Cutthroat					
Other					

Bartlett Creek Fish Data: 8/11/97 1 mi. above Bartlett Pt. Rd. No Fish Collected

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Grant Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
At Bartlett Rd. Crossing	024_03	1	1	2.35	7/14/98

Grant Creek Fish Data: 7/8/97 0.75 mi. above Bartlett Pt. Rd. No Fish Collected.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Chilly Slough BURP Data: No BURP Data

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled

Chilly Slough Fish Data: 6/25/97 At Whiskey Spring

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	41	100	51.9	40	78
Cutthroat					
Other					

Sage Creek BURP Data: 1st order N. Fork and Main Sage above Corral.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
1 mi. above Forks	022_02	3	3	8.16	6/29/98
Below Corral Cr.	022_02	3	2	2.56	6/29/98
North Fk. 200m above Forks	022_02	2	3	2.75	6/29/98

Big Lost River Subbasin Assessment and TMDL

Sage Creek Fish Data: 6/14/96 at point of diversion: No Fish Collected (no fish collected 7/22 99 by DEQ)

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Bradshaw Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
80 m above N.Fk SageCr	022_02	2	1	1.15	6/29/98

Lone Cedar Creek BURP Data: 1st order No BURP Data: Dry

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
10 m below private ranch	017_02			Dry	8/15/01

Lone Cedar Creek Fish Data: No Fish Data

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Upper Cedar Creek BURP Data: No BURP Data: Dry

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
At Hwy 93				Dry	8/15/01

Upper Cedar Creek Fish Data: 6/7/96 No fish collected above diversion

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Lower Cedar Creek BURP Data: No BURP Data: stream completely diverted at canyon mouth.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
At Lower Cedar Rd. below private				Dry	

Lower Cedar Creek Fish Data: 7/2/96 No Fish collected above diversion

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					

Big Lost River Subbasin Assessment and TMDL

Willow Creek BURP Data: 1st order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.5 mi. below spring	020_03	1	1	1.05	7/14/98

Willow Creek Fish Data: 6/13/96 below forks in Section 33

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	48	100	138.7	44	235
Cutthroat					
Other					

Rock Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
2 mi. above Willow Cr.	019_02	2	3	14.3	7/14/98

Warm Springs Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
50 m below Lost River Ranch	043_02	2	1	36.1	8/2/96

Warm Springs Creek Fish Data: No Fish Data: multiple year classes of rainbow trout present

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook					
Cutthroat					
Other					

Navarre Creek BURP Data: Main stem, N., W., Middle Forks

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
(main) 0.25 mi. below Forks	044_03	2	2	11.27	7/8/98
(mid) 0.8 mi. above Forks	044_02	3	3	5.97	7/8/98
(west) 40 m above Forks	044_02	1	3	1.34	7/8/98
(east) 0.5 mi. above main stem.	044_02 Intermittent	2.4 (MBI)	99 (HI)	2.5	7/8/98

Navarre Creek Fish Data: 6/1/96 Main Stem at Forest Boundary

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	3	100	126.3	99	140
Cutthroat					

Big Lost River Subbasin Assessment and TMDL

Navarre Creek Fish Data: DEQ data No fish collected in East or Middle Forks, 1 fish each in main stem and West Fk.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	2	100	150	145	155
Cutthroat					
Other					

Antelope Creek BURP and Fish Data

Antelope Creek BURP Data: 7/18 sample listed as Cherry Cr. actually Antelope

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
0.5 mi. below Iron Bog Cr.	052_04	3	1	13.57	7/11/94
1 mi. below Cherry Cr.		4.11 (MBI)	60 (HI)	7.90	7/18/94
At Hwy. 93				Dry	8/15/01
100 m below Hwy. 93				Dry	7/18/94
At Hwy. 93	Intermittent	3.45(MBI)	56 (HI)	33.73	7/20/95

Antelope Creek Fish Data: 8/7/96 Antelope Creek Above Horsethief Cr., 0.3 mi. up FS Rd. 574

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	3.45	131	131	131
Brook	28	96.55	162	36	312
Cutthroat					
White Fish					

Antelope Creek Fish Data: July 1991: IDFG Data Antelope Creek: location of 6 transects not stated

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	15	27	208.6	58	320
Brook	41	73	169	95	286
Cutthroat					
White Fish					

Bailey Corral Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
Just above Cherry Cr. Rd	049_02	0	1	0.32	7/6/98

Flower Garden Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
80m above Forks	049_02	0	1	0.68	7/6/98

Big Lost River Subbasin Assessment and TMDL

McKey Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
20 m above Cherry Cr.	049_02	3	1	0.23	7/6/98

Bear Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
At Forks	053_03	3	3	15.3	7/2/97
1 mi. below Forks	053_03	3	3	11.73	7/10/96
2 mi. above Antelope Cr.	053_03	3	1	14.6	7/10/96
Right Fork 25 m above 2 nd Rd xing	053_02	3	1	14.6	7/10/96
Middle Fork 300 m above confluence	053_02	3	3	11.9	7/11/96

Bear Creek Fish Data: 8/8/96 2 mi. above Antelope Cr. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1	1.85	86	86	86
Brook	53	98.15	120.5	52	230
Cutthroat					
White Fish					

Bear Creek Fish Data: 8/8/96 1.1 mi. above Antelope Cr. Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	40	100	141.0	39	251
Cutthroat					
White Fish					

Cherry Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
L.Fk Cherry, 3mi. above Cherry Cr.	051_02	3	1	4.93	7/11/94
0.75 mi. above Richardson Canyon	050_04	1	1	0.08	7/11/94

Cherry Creek Fish Data: 10/11/96 Left Fork Cherry Creek (largest flow) 1.3 mi. above Antelope Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	56	44.8	105	22	243
Brook	69	55.2	155	73	244
Cutthroat					
White Fish					

Big Lost River Subbasin Assessment and TMDL

Cherry Creek Fish Data: 8/13/96 Cherry Creek 0.1 mi. above Forest/private boundary

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	72	100	94.9	41	251
Cutthroat					
White Fish					

Richardson Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
250 m above Cherry Cr.	050_02	3	3	1.33	7/6/98

Lupine Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
Just above Rt. & L Fks.	050_02	2	3	1.13	7/6/98

Carcass Creek BURP Data: 1st Order

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
150 m above Lupine Cr.	050_02	0	1	0.29	7/6/98

Iron Bog Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
1 mi. above Antelope Cr.	054_03	3	1	58.5	7/10/96
100 m above confluence		N/A	N/A	6.12	8/16/01

Iron Bog Creek Fish Data: August 1996 in RNA 2 mi. above Antelope confluence

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	2	4.2	144	98	190
Brook	46	95.8	124.9	34	230
Cutthroat					
White Fish					

Left Fork Iron Bog Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
1 mi. above Forks confluence	056_02	3	3	28.03	7/9/96
5 m above Forks confluence		N/A	N/A	4.84	8/21/01

Big Lost River Subbasin Assessment and TMDL

Left Fork Iron Bog Creek Fish Data: 6/25/96 600 m above Right Fork Iron Bog Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	8	100	154.4	85	188
Cutthroat					
White Fish					

Left Fork Iron Bog Creek Fish Data: 6/25/96 1.75 mi. above campground at upper RNA

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	12	100	132.6	95	218
Cutthroat					
White Fish					

Right Fork Iron Bog Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
1 mi. above Forks confluence	055_02	2	3	23.5	7/9/96
5 m above Forks confluence		N/A	N/A	4.7	8/21/01

Right Fork Iron Bog Creek Fish Data: 9/9/96 R. Fk. Iron Bog 50 m above gate at trailhead

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	19	100	149.6	46	249
Cutthroat					
White Fish					

Smiley Creek BURP Data:

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
500 m above Antelope Cr.	055_02	3	3	3.68	7/9/96

Horsethief Creek BURP Data:

BURP Site Location	Assessment Unit	MBI Score	Habitat Score	Flow	Date Sampled
0.25 mi. above Antelope Cr.	052_02	3	1	5.75	7/2/97

Horsethief Creek Fish Data: 7/99 DEQ 0.25 mi. above Antelope Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	4	100	150	125	185
Cutthroat					
White Fish					

Big Lost River Subbasin Assessment and TMDL

Dry Canyon Creek BURP Data:

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow	Date Sampled
0.25 mi. above Antelope Cr.	052_02	1	1	0.052	7/2/97

Leadbelt Creek BURP Data:

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow	Date Sampled
2 mi. above Cabin Cr.	047_02	N/A	Beaver Dams	Not Measured	7/8/96
0.5 mi below Cabin Cr.		N/A	N/A	Dry	8/21/01
25 m below Deer Cr.	047_02	3.52	63	0.68	7/8/96

Leadbelt Creek Fish Data: 9/9/96 at Beaver complex 200 m above Fish Creek Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	31	84	57.1	36	71
Brook	6	16	107.8	89	127
Cutthroat					
White Fish					

Lower Big Lost River BURP and Fish Data

Lower Big Lost River Big Lost River BURP Data: 2001 is 4 miles above Moore Diversion

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow	Date Sampled
Hwy 93 between Leslie & Darlington		N/A	N/A	No Flow	8/15/01
3.5 mi. below Moore Diversion		2.29	61	83.26	8/29/95
Challis Rd. Bridge near Arco		1.81	48	33.85	8/29/95

Lower Big Lost River Fish Data: 1991 Idaho Fish and Game Data: Near Mackay, ID

Species	Total Estimated	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	1730	85.9	285	45	575
Brook	284	14.1	200	95	370
Cutthroat					
White Fish	12% of sample	N/A	N/A	N/A	N/A

Lower Big Lost River Fish Data: 1991 Idaho Fish and Game Data: Near Leslie, ID

Species	Total Estimated	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	344	47.9	250	75	525
Brook	373	52.1	180	60	300
Cutthroat					
White Fish	20% of sample	N/A	N/A	N/A	N/A

Big Lost River Subbasin Assessment and TMDL

South Fork Alder Creek BURP Data:

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
15 m above Forks	045_02	3	3	5.28	7/7/98

South Fork Alder Creek Fish Data: 9/9/97 300 m above Alder Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	22	100	103.7	73	178
Cutthroat					
White Fish					

Fish Data: 9/9/97 Alder Creek 100 m above private property

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow	4	4.54	78.5	46	171
Brook	84	95.45	135.58	60	225
Cutthroat					
White Fish					

Fish Data: 9/9/97 Alder Creek Between Sawmill and Trail Creeks at road crossing culvert

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	31	100	143.2	51	260
Cutthroat					
White Fish					

Cliff Creek BURP Data: 1st Order

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
¼ mile below end of Rd.	045_02	1	3	4.72	7/15/98

Trail Creek BURP Data:

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
50 m above Alder Cr.	045_02	3	3	5.81	7/7/98

Trail Creek Fish Data: 9/9/97 Trail Creek 300 m above Alder Creek Rd.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	20	100	179.5	90	248
Cutthroat					
White Fish					

Big Lost River Subbasin Assessment and TMDL

Pass Creek BURP Data:

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
0.25 mi. above Lime Cr.		3.96 (MBI)	94 (HI)	0.17	7/13/98
0.25 mi. below Lime Cr.		5.16 (MBI)	96 (HI)	0.7	7/13/98
20 m below Bear Cr.	009_03	3	3	10.93	7/13/98

Pass Creek Fish Data: 7/21/99 DEQ Data Pass Creek 1.5 mi. below Bear Creek.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	13	100	177.3	95	225
Cutthroat					
White Fish					

Pass Creek Fish Data: 7/21/99 DEQ Data Pass Creek 0.25 mi. below Lime Cr.

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	9	100	127.2	45	235
Cutthroat					
White Fish					

Lime Creek BURP Data: 1st Order

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
100 m above Pass Creek	009_02	3	3	0.32	7/13/98

Bear Creek BURP Data:

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
0.1 mi. above Pass Cr.	009_02	2	3	4.1	7/1/97
1.4 mi. above Pass Cr.	009_02	0	3	2.49	7/13/98

Bear Creek Fish Data: 7/21/99 DEQ Data: just above Bear Creek confluence with Pass Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	13	100	208	195	235
Cutthroat					
White Fish					

Bear Creek Fish Data: 7/21/99 DEQ Data: 1.4 mi. above Bear Creek confluence with Pass Creek

Species	Total Captured	Percent Composition	Mean Length	Minimum Length	Maximum Length
Rainbow					
Brook	11	100	185	165	215
Cutthroat					

Appendix G. Erosion Inventory Methodology

Erosion Inventory Methods

February 25th, 2003

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Abstract

Water quality managers often are faced with difficult decisions on how to satisfy needs of states to meet court ordered schedules to develop Total Maximum Daily Loads while establishing meaningful load allocations and targets to improve water quality and meeting the public need to maintain diversity in land use. Such decisions are fraught with complexity and uncertainty associated with ecological systems, perturbation of water quality by anthropogenic nonpoint sources, such as sediment, and implementation of affordable best land management practices. Quantitative erosion inventory provides a means to formalize these complexities into a framework consisting of sediment load estimates from primary sources and relating loads to undisturbed conditions of bank stability, bank height and length and beneficial use support to identify load allocations that are expected to restore impacted beneficial uses. Determining percent composition of surface and depth fine sediment in spawning habitat is used as a complementary target to track changes in sediment loading over time.

Methodology for streambank erosion inventory is presented to determine existing sediment load, desired future sediment load, and monitoring feedback to guide implementation of best management practices to restore full support of beneficial uses related to coldwater aquatic life and salmonid spawning. This inventory is intended for waters determined to be primarily degraded by sediment or the combination of sediment and elevated temperature. The primary supposition is that as streambanks are managed for stability the morphological and riparian changes facilitate reduced thermal loading. The erosion inventory was developed to identify sediment loading at existing erosion rates and to identify future desired sediment loading based on erosion rates predicted after implementation of best management practices. This methodology was applied to the Lemhi River Subbasin to quantify streambank erosion on 303(d) listed streams to develop Total Maximum Daily Loads to meet the requirements of the Federal Clean Water Act.

Introduction

Water quality managers are increasingly faced with difficult decisions on how to balance the legal requirements of the Federal Clean Water Act for quantitative Total Maximum Daily Loads (TMDLs) with socioeconomic needs of the public. Streams that do not fully support aquatic life beneficial uses due to degraded water quality require that a TMDL be developed to restore aquatic life beneficial uses. The need for sustainable agriculture is important to rural economies and implementation of excessive best management practices is not affordable or desirable. Court ordered timelines for development of TMDLs for particular streams require that load allocations be meaningful to restoration of desirable aquatic conditions and be completed in a short time. Budgets for environmental regulatory agencies preclude extensive analysis of pollutant loading to develop load allocations. Federal law requires only gross allocations of pollutant loads in the absence of existing data of high precision. To aid the decision-making process, managers need tools that formalize the collection of sediment loading data, are quantitative and relate present day erosion conditions to future target conditions that are expected to restore beneficial uses. These methodologies must be cost effective and time efficient, while providing realistic implementation alternatives to ranchers and farmers. The streambank erosion inventory is a rapid and inexpensive assessment of current erosion conditions and identifies load reductions needed to achieve desired future conditions that are expected to restore beneficial uses. The implementation alternatives

identified by the erosion inventory are generally inexpensive and attainable in a reasonable time to effect improvements in water quality and subsequent aquatic life beneficial use support. This methodology was used to quantify bank erosion over 28 segments of tributaries to the Lemhi River to develop a TMDL for the Lemhi River Subbasin to restore aquatic life beneficial uses. It has also been successfully used in the Pahsimeroi River and Little Lost River subbasins to identify load reductions to restore beneficial aquatic life uses and reduce thermal loading.

The analytical techniques and data used to develop the gross sediment budget and instream sediment measures used in rangeland TMDLs in the Salmon River and Upper Snake River Basins is described. The methods, data, and results for: 1) streambank erosion inventory; 2) gully erosion and mass wasting inventory; and 3) surface and subsurface fine sediment data collection techniques are reviewed. These data are intended to first characterize the natural and existing condition of the landscape, and second to estimate the desired level of erosion and sedimentation, and third provide baseline data which can be used in the future to track the effectiveness of TMDL implementation. For example, the streambank erosion and gully inventories can be repeated, as can evaluation of depth or surface fine sediment composition to ultimately provide an adaptive management or feedback mechanism.

Methods

Streambank Erosion Inventory

The streambank erosion inventory used to estimate background and existing streambank erosion followed methods outlined in the proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (NRCS, 1983). Using the direct volume method, sub-sections of 1996 §303(d) watersheds were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

The NRCS Stream Bank Erosion Inventory is a field based methodology, which measures streambank/channel stability, length of active eroding banks, and bank geometry (Stevenson, 1994). The streambank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of streambank characteristics that are assigned a categorical rating ranging from 0 to 3. The categories of rating the factors and rating scores are:

Bank Stability:

- Do not appear to be eroding - 0
- Erosion evident - 1
- Erosion and cracking present - 2
- Slumps and clumps sloughing off - 3

Bank Condition:

- Some bare bank, few rills, no vegetative overhang - 0
- Predominantly bare, some rills, moderate vegetative overhang - 1
- Bare, rills, severe vegetative overhang, exposed roots - 2
- Bare, rills and gullies, severe vegetative overhang, falling trees - 3

Vegetation / Cover On Banks:

- Predominantly perennials or rock-covered - 0
- Annuals / perennials mixed or about 40% bare - 1
- Annuals or about 70% bare - 2
- Predominantly bare - 3

Bank / Channel Shape:

- V - Shaped channel, sloped banks - 0
- Steep V - Shaped channel, near vertical banks - 1
- Vertical Banks, U - Shaped channel - 2
- U - Shaped channel, undercut banks, meandering channel - 3

Channel Bottom:

- Channel in bedrock / noneroding - 0
- Soil bottom, gravels or cobbles, minor erosion - 1
- Silt bottom, evidence of active downcutting - 2

Deposition:

- No evidence of recent deposition - 1
- Evidence of recent deposits, silt bars - 0

Cumulative Rating

Slight (0-4) Moderate (5-8) Severe (9+)

From the Cumulative Rating, the lateral recession rate is assigned.

0.01 - 0.05 feet per year	Slight
0.06 - 0.15 feet per year	Moderate
0.16 - 0.3 feet per year	Severe
0.5+ feet per year	Very Severe

Streambank stability can also be characterized through the following definition and the corresponding streambank erosion condition rating from Bank Stability or Bank Condition above are included in italics.

Streambanks are considered stable if they do not show indications of any of the following features:

- **Breakdown** - Obvious blocks of bank broken away and lying adjacent to the bank breakage. *Bank Stability Rating 3*
- **Slumping or False Bank** - Bank has obviously slipped down, cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*
- **Fracture** - A crack is visibly obvious on the bank indicating that the block of bank is about to slump or move into the stream. *Bank Stability Rating 2*
- **Vertical and Eroding** - The bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Streambanks are considered covered if they show any of the following features:

- Perennial vegetation ground cover is greater than 50%. *Vegetation/Cover Rating 0*
- Roots of vegetation cover more than 50% of the bank (deep rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*
- At least 50% of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*

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- At least 50% of the bank surfaces are protected by logs of 4 inch diameter or larger.
Vegetation/Cover Rating 1

Streambank stability is estimated using a simplified modification of Platts, Megahan, and Minshall (1983, p. 13) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton, 1993). The modification allows for measuring streambank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

- **Mostly covered and stable (non-erosional).** Streambanks are Over 50% Covered as defined above. Streambanks are Stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0 - 4 (slight erosion) with a corresponding lateral recession rate of 0.01 - 0.05 feet per year.*
- **Mostly covered and unstable (vulnerable).** Streambanks are Over 50% Covered as defined above. Streambanks are Unstable as defined above. Such banks are typical of "false banks" observed in meadows where breakdown, slumping, and/or fracture show instability yet vegetative cover is abundant. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and stable (vulnerable).** Streambanks are less than 50% Covered as defined above. Streambanks are Stable as defined above. Uncovered, stable banks are typical of streambanks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and unstable (erosional).** Streambanks are less than 50% Covered as defined above. They are also Unstable as defined above. These are bare eroding streambanks and include ALL banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Streambanks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to be used for TMDL development.

Site Selection

The first step in the bank erosion inventory is to identify key problem areas. Streambank erosion tends to increase as a function of watershed area (NRCS, 1983). As a result, the lower stream segment of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches (Rosgen B and C channel types) (Rosgen, 1996). Because it is often unrealistic to survey every stream segment, sampled reaches were used and bank erosion rates are extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and consistent geometry need less. Typically between 10 and 30 percent of streambank needs to be inventoried. Often, the location of

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some stream inventory reaches is more dependent on land ownership than watershed characteristics. For example, private land owners are sometimes unwilling to allow access to stream segments within their property.

Stream reaches are subdivided into *sites* with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites. Subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

Streambank erosion or channel stability inventory field methods were originally developed by the USDA USFS (Pfankuch, 1975). Further development of channel stability inventory methods are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document outlines field methods used in this inventory. However, slight modifications to the field methods were made and are documented.

Field crews typically consist of two to four people and are trained as a group to ensure quality control or consistent data collection. Field crews survey selected stream reaches measuring bank length, slope height, bankfull width and depth, and bank content. In most cases, a Global Positioning System (GPS) is used to locate the upper and lower boundaries of inventoried stream reaches. Additionally, while surveying field crews photograph key problem areas.

Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on bank recession rate determined in the survey (NRCS, 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor.

The direct volume method is summarized in the following equations:

$$E = [A_E * R_{LR} * \rho_B] / 2000 \text{ (lbs/ton)}$$

where:

E = bank erosion over sampled stream reach
(tons/yr/sample reach)

A_E = eroding area (ft²)

R_{LR} = lateral recession rate (ft/yr)

ρ_B = bulk density of bank material (lbs/ft³)

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The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:

E_R = bank erosion rate (tons/mile/year)

E = bank erosion over sampled stream reach
(tons/yr/sample reach)

L_{BB} = bank to bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge (Leopold et al, 1964). Because channel erosion events typically result from above average flow events, the annual average bank erosion value should be considered a long term average. For example, a 50 year flood event might cause five feet of bank erosion in one year and over a ten year period this events accounts for the majority of bank erosion. These factors have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding. For example, the bank on the outside of a meander. However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS, 1983). Several techniques are available to quantify bank erosion rates: for example, aerial photo interpretation, anecdotal data, bank pins, and channel cross-sections.

To facilitate consistent data collection, the NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates. For the Lemhi River, anecdotal data were used to estimate bank recession rates. Table 1 summarizes the results and recession rates are in

Table 1. Bank lateral recession rates measured in Lemhi River Subbasin using anecdotal data.

Site	Lateral Recession (ft)	Time (yr)	Recession Rate (ft/yr)	Comments
18 - mile Creek (silt-clay)	2.5	2	1.25	Bank erosion results from cattle trampling bank rather than stream discharge. Likely not a good measure for other streams.
Kitley Creek (clay-silt)	14	37	0.38	Fence posts exposed, Fence built in late 1950s. Assume 1960 for rate calculation. Two feet lost in 1997 flood event.
Geertson Creek (silt-sand)	15	52	0.29	Cedar fence built in 1945.

general agreement with the NRCS (1983) categories. Additionally, Table 2 is included to compare estimated recession rates to rates measured in recent research projects.

The *bulk density* (ρ_B) of bank material is measured occularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of

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typical soil bulk densities can be used, or soil samples can be collected and soil bulk density measured in the laboratory.

Gully Erosion and Mass Wasting

Table 2. Bank lateral recession rate measured in various research projects.

Reference	Average Migration Rate (ft/yr)		Comments
	forested	unforested	
From Burckhardt and Todd (1998)	0.7	5.3	Data collected in North Central Missouri in glacial deposits. Included here to show extreme values in highly unstable sand-gravel bank material.
	1.9	5.6	
	1.4	3.1	
	2.3	7	
	0.3	1.7	
	0.9	5.6	
	2.3	10.5	
	4.5	8.6	
	0.6	0.9	
From Trimble (1997)	0.65		Urbanized watershed. Sand-silt bank material
	13		

Two methods were used to estimate the natural and anthropogenic frequency of gully erosion and mass wasting. First, field inventories were conducted to quantify the present level of gully formation and mass wasting occurrence. Second, historic aerial photos were used to document the spatial and temporal characteristics of gully formation and mass wasting.

The gully erosion field inventory followed methods outlined in the proceedings from the Natural Resource Conservation Service Channel Evaluation Workshop (1983). Much like the streambank erosion inventory technique, the direct volume method is used to quantify the amount and rate of sediment erosion and delivery from gullies.

The mass wasting inventory was conducted using similar techniques, however, because these features tend to be discrete sources of sediment the average annual sediment input was not quantified. Rather, the total volume and mass delivered to the stream channel were estimated.

Active features were surveyed using standard surveying equipment. The geometry of each feature was surveyed and sediment samples were collected. The sediment samples were sieved and weighed to quantify the cumulative grain size distribution of the sediment sources. These data are reported in Plate 9.

The aerial photos were interpreted using standard techniques described by Compton (1996). Resource aerial photos, taken by the BLM, from 1946, 1960, 1974, 1992, and 1993 were used to characterize the location of features and to quantify the approximate time of gully and mass wasting initiation. The photos were also used to characterize changes in land use, riparian cover, and bank condition where possible.

Subsurface Fine Sediment Sampling

McNeil Sediment Core samples were collected to describe size composition of bottom materials in salmonid spawning beds of streams on the 303(d) list for sediment. Research has shown that subsurface fine sediment composition is important to egg and fry survival, Hall (1986), Reiser and White (1988). Data gathered as part of the TMDL and other studies relevant to the Lemhi River Subbasin are presented in Plate 10.

Site Selection

Sample sites selected displayed characteristics of gravel size, depth and velocity required by salmonids to spawn and were determined to be adequate spawning substrate by an experienced fisheries biologist. Samples were collected during periods of low discharge, as described in McNeil and Ahnell (1964) to minimize loss of silt in suspension within the core sampling tube. Sample sites were generally in the lower reach of streams where spawning habitat was determined to exist.

Field Methods

A 12 inch stainless steel open cylinder is worked manually as far as possible, at least 4 inches, into spawning substrate without allowing flowing water to top the core sampling tube. Samples of bottom materials were removed by hand, using a stainless steel mixing bowl, to a depth of at least 4 inches and placed into buckets. After solids were removed from the core sampling tube and placed into buckets, the remaining suspended material was discarded. It is felt that this fine material would be removed through the physical action of excavating a redd and would not be a significant factor with regard to egg to fry survival. Additionally, rinsing of sieves to process the sample results in some loss of the fraction below the smallest (0.053 mm) mesh size.

Samples were placed wet into a stack of sieves and were separated into 10 size classes by washing and shaking them through nine standard Tyler sieves having the following square mesh openings (in mm): 63, 25, 12.5, 6.3, 4.75, 2.36, .85, .212, .053. Silt passing the finest screen was discarded.

The volume of solids retained by each sieve was measured after the excess water drained off. The contents of each of the sieves were placed in a bucket filled with water to the level of a spigot for measurement by displacement. The water displaced by solids was collected in a plastic bucket and transferred to a 2,000 ml graduated cylinder and measured directly. Water displaced by solids retained by the smaller diameter sieves was also collected in a plastic bucket and measured in a 250 ml graduated cylinder. Variation in sample volumes was caused by variation in porosity and core depth. All sample fractions were expressed as a percentage of the sample with and without the 63 mm fraction.

Three sediment core samples were collected at each sample site and grouped together by fractions 6.3 mm and greater and 4.75mm to 0.53mm. The results for a particular site are the percentage of 4.75mm to 0.53mm as a percent of the total sample. Standard deviation is calculated for estimates including and excluding particles 63 mm and above.

Results

The output from the erosion inventory gives tons per year per sample reach, tons per mile per year and extrapolated total tons of sediment per year from streambank erosion over the length of stream identified as having similar management and erosion conditions. Estimates for the same parameters are calculated for the same stream segments at the desired streambank stability. The difference of the two estimates becomes the load allocation from which the TMDL is developed. A summary table of streambank erosion estimates is shown in Table 3.

Table 3. Example of sediment load allocations and reductions by inventory reach.

Reach Name/Number (from downstream to upstream)	Existing Erosion Rate (t/mi/y)	Total Erosion Rate (t/y)	Proposed Erosion Rate (t/mi/y)	Load Allocations (t/y)	Erosion Rate Percent Reduction	Percent of Total Erosion
Landslide	N/A	195	N/A	146	25	19
Upper	71	318	36	159	49	31
3 (Upper Middle)	10	46	6	28.5	40	5
2 (Middle)	5	6	6	8	0	<1
1 (Lower)	96	422	71	313	26	42
5 Road	9	24	5	14	44	2
Totals	-----	1011		668	34	100

The output from the McNeil Sediment Core Sample shows the percent composition of fine sediment less than ¼ inch diameter for each sample site. The target for volcanic, granitic and sedimentary watersheds is less than 28% fine sediment less than ¼ inch diameter in identifiable spawning habitat. Spawning habitat primarily consists of pool tail-outs. Channel morphology provides flow dynamics that result in fine sediment levels less than 28% in unperturbed conditions. Excessive fine sediment inputs or disturbed channel morphology are indicated by fine sediment composition above 28%. Target levels set by the USDA Forest Service Salmon-Challis National Forest set target levels at less than 20% fine sediment to a depth of 6 inches in streams with anadromous fish and to a depth of 4 inches in streams with exclusively resident fish species. A summary table of fine sediment composition from core samples is shown in Table 4.

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Table 4. Example of sediment core sampling data.

Core Sampling Sediment Trends - 1995 to 1999 - Mean Percent (%) Fines					
Stream/Station	1995	1996	1997	1998	1999
Morgan Cr.1A	38.5	34.3	29.3	22.8	24.8*
Morgan Cr.2A	34.4	34.5	31.7	22.0	23.8*
Morgan Cr.3A	42.3	27.7	41.3	31.4	39.4
Morgan Cr.	36.2	33.0	23.4	11.4	25.6*
Challis Cr.1A	44.1	41.1	17.4	13.0	21.3*
Challis Cr.2A	-	-	29.2	-	22.0
Garden Cr.1A	22.4	-	19.0	12.3	18.0*
E. Pass Cr.1A	27.1	31.9	31.2	37.9	38.8#
Herd Cr.	30.1	31.0	32.5	28.4	30.7
WF Herd Cr.1A	20.4	27.2	27.2	27.2	25.2#
Squaw Cr.1A	25.9	24.2	27.4	23.5	30.5#
Trail Cr.1A	-	27.0	-	-	-
Thompson Cr.1A	25.1	20.2	25.4	16.5	_*
Yankee Fork 1A	27.1	20.5	19.6	27.8	24.1
Yankee Fork 2A	15.6	29.5	14.9	22.6	27.5#
Yankee Fork 3A	13.2	29.1	5.3	14.7	24.2#
Yankee Fork 4A	40.6	36.1	27.4	25.2	32.7*
Yankee Fork 5A	31.5	29.7	23.6	21.0	15.7*
WF Yankee Fork	21.9	-	27.5	18.1	25.1
Jordan Cr.0A	26.2	32.1	18.4	13.9	15.3*
Jordan Cr.1A	17.6	-	-	-	-
Jordan Cr.2A	16.0	22.5	18.0	17.5	21.1#
Jordan Cr.3A	14.3	23.5	16.7	10.9	23.1#
Jordan Cr.4A	13.5	-	-	-	-
Fivemile Cr.1A	14.3	-	20.8	28.8	11.7
Tenmile Cr.1A	32.3	-	36.9	28.5	33.7
McKay Cr.1A	19.0	-	29.3	33.2	30.1#
Basin Cr.1A	33.3	28.5	22.3	13.5	32.4
Valley Cr.1A	41.1	-	-	-	-

*Significant decrease over the five-year period (1995-1999).

#Significant increase over the five-year period (1995-1999).

Streams in **bold** are 303(d) listed for sediment.

Discussion

Sediment loading above the level that a water body can assimilate is the most frequently observed perturbation to cold water aquatic life beneficial use support in waters that occur in areas where the primary land use is livestock grazing. Unmanaged or undermanaged grazing in riparian areas results in degradation of riparian vegetation, which in turn results in unstable streambanks which increases sediment loading from eroding streambanks. Over time channel morphology changes,

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increasing width, decreasing depth and increasing deposition of fine sediment and increasing thermal loading.

Establishing an efficient method of evaluating streambank erosion and depth fine deposition gives water quality managers a quantitative tool to set pollutant loads, prioritize implementation of best management practice projects, and monitor implementation effectiveness. Combined with monitoring aquatic life beneficial uses and follow-up monitoring of fine sediment targets and channel morphology a valuable tool is gained to restore water quality while providing impetus to implement best management practices that are cost effective and assure sustainable agriculture for the future.

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